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Rubber Research Scheme

(CEYLON).

Third Quarterly Circular

FOR

1925.

IMPERIAL BUREAU OF MYCOLOGY
25 MAR. 1927

Peradeniya, October, 1925.

(THIS CIRCULAR IS PRINTED ON RUBBER LATEX PAPER.)

GENTLEMEN,

Herewith the Third Quarterly Circular for 1925 dealing with the following subjects:—

"*Para* nitrophenol as a preventive of Mould on Sheet Rubber."
By T. E. H. O'Brien, Chemist.

"A Brown Bast Census."
By R. A. Taylor, Physiological Botanist.

"The Effect of Manuring on the Foliage Cover in Rubber."
By R. H. Stoughton-Harris, Mycologist.

"Plasticity of Rubber."
Received from the London Advisory Committee.

Reports received.

J. MITCHELL,
Organising Secretary.

RUBBER RESEARCH SCHEME (CEYLON),
Peradeniya, 26th October, 1925.

PARA NITROPHENOL AS A PREVENTIVE OF MOULD ON SHEET RUBBER.

One of the most common troubles which occur in connection with smoked sheet manufacture is that, under adverse conditions, the sheets are liable to become mouldy while in transit from producer to consumer. While it has many times been shown that a light growth of mould has no harmful effect on the rubber, this defect is frequently made an excuse by the broker for claiming a reduction in price.

During the past two years experiments have been in progress at the Research Scheme Laboratories to determine whether conditions of smoking can be so arranged that mould is entirely prevented. It has been shown that liability to mould can be minimised by attention to certain points in manufacture (*see* Chemist's Report for 1924), and that in cases where an estate has abnormal trouble with mould it can usually be traced to incorrect methods of manufacture. It is equally clear however that sheet rubber cannot be made entirely immune to mould by smoking. The conclusion is therefore reached that if it is desired to make smoked sheet quite free from liability to mould, the question of adding some disinfectant to the rubber must be considered.

Rubber scientists have for a long time been looking for some suitable chemical for this purpose. Many substances have been tried, but until recently none had been tested which was altogether satisfactory. The Scientific Officers of the Rubber Growers' Association have recently experimented with a substance called *para* nitrophenol, and results of tests indicate that this chemical is likely to be of great value as a preventive of the chief defect of smoked sheet.

The essential qualities of a substance for this purpose are as follows:—

1. It must be cheap. - Commercial *para* nitrophenol should not exceed Rs. 1-50 per pound in Colombo.
2. It must be effective in small quantities. - 0.1% (calculated on weight of rubber) appears to be sufficient to prevent mould.
3. It must be easy to handle and should preferably be soluble in water. - *Para* nitrophenol is a stable solid and is sufficiently soluble in water for the purpose.

4. It must have no harmful effect on the rubber.	- Vulcanisation tests carried out by the Rubber Growers' Association show that it has no appreciable effect on the rubber. Dr. H. P. Stevens concludes a recent report as follows: "Once more the conclusion is reached that *para* nitrophenol can be safely used as a fungicide without any deteriorating effect on the rubber." (R. G. A. Bulletin, Vol. 7, p. 498.)
5. It should not affect the appearance of the rubber.	- *Para* nitrophenol has no effect on the appearance of smoked sheet.

According to reports from Malaya the substance can be used in two ways :—

1. An appropriate quality can be dissolved in the acid used for coagulation and thus introduced into the latex.

2. The sheets after rolling and washing can be soaked in a dilute solution of the disinfectant.

Tests carried out in these laboratories show that the first method would probably not prove altogether satisfactory under Ceylon conditions. One of the disadvantages of *para* nitrophenol is that it has a slight clotting effect on latex. This is not of importance under Malayan conditions where coagulation is carried out in tanks and after addition of acid it remains only to place partitions in position. In Ceylon however, after addition of acid, the latex has to be transferred to pans or troughs, and there is a danger that clotting might set in before this is complete, thereby spoiling the appearance of some of the sheets. In a test in which *para* nitrophenol was used in the proportion of 0.1% it was found that clotting started about 10 minutes after addition of the acid.

The second method therefore appears to be most suitable for adoption in Ceylon. The sheets, after rolling and washing in the usual way, are soaked in a weak solution of the disinfectant for $\frac{1}{2}$—1 hour and then hung to drain and removed to the smoke-house. It is important that while the sheets are being soaked they should be turned over at intervals; otherwise parts of the sheet might not come in contact with the disinfectant and would naturally not be protected against mould.

Tests have been carried out in these laboratories which fully confirm the results reported by the R. G. A. Officers in Malaya. Results of one series of experiments are given below. Samples of sheet were prepared in which different amounts of *para* nitrophenol were added to the latex with the coagulating acid. Other sheets were washed after rolling, in solutions of *para* nitrophenol of various concentrations. The sheets were then smoked and tested for liability to mould by the standard test devised by Dr. De Vries; *i.e.*, pieces of sheets are inoculated with mould and placed in a vessel over a 7% solution of common salt which provides a very moist atmosphere. A comparison is made of the amount of mould on different samples after a certain length of time. These tests were repeated on samples which had been hung to air dry for 8 days after smoking.

1. *PARA* NITROPHENOL ADDED TO THE LATEX.

Appearance of sheet after 21 days in mould testing chamber.

Amount Added.	1st Test. (after smoking.)	2nd Test. (8 days after smoking)
Nil	Sheet covered with mould	Sheet covered with mould
0.05%	Patches of mould	Patches of mould
0.1 %	No mould	No mould
0.15%	do	do
0.2 %	do	do

2. SHEETS SOAKED IN *PARA* NITROPHENOL

Strength of Solution.	1st Test. (after smoking.)	2nd Test. (8 days after smoking.)
Nil	Sheet covered with mould	Sheet covered with mould
0.05%	No mould	No mould
0.1 %	do	do
0.15%	do	do
0.2 %	do	do

It is also reported by the R. G. A. Officers that *para* nitrophenol is of value in crepe manufacture as a preventive of spots. It is recommended by them that the thin crepe after rolling should be soaked in a dilute solution of the chemical. This method appears to have the distinct disadvantage that a considerable amount of liquid would be

held by the crepe and would be transferred to the drying sheds. Tests were made here to determine whether the chemical could be incorporated in the latex in the manner suggested for sheet manufacture, but in each case the colour of the finished blanket crepe was poor. The former method would doubtless merit consideration by any estate which had serious trouble with spotted crepe.

USE OF *PARA* NITROPHENOL.

It is considered by the Research Scheme that *para* nitrophenol is likely to be of considerable value as a disinfectant in rubber manufacture.

For mould prevention *para* nitrophenol should be dissolved in water in the proportion of 1 lb. to 100 gallons water. The freshly rolled sheets after washing should be soaked in the solution for ½—1 hour, taking care that the sheets are turned over at intervals. They should then be hung to drip and transferred to the smoke-house. It is stated by the R. G. A. Officers that the solution can be used for 2 days in succession and should then be thrown away.

Arrangements are being made for a Colombo firm to obtain stocks of *para* nitrophenol. In the meantime a few ¼ lb. samples are available on application to the laboratories. If any estate contemplates ordering the chemical direct from England, it would be advisable to communicate with the writer, in order to obtain a specification of a grade suitable for the purpose.

For full details of tests carried out by the Officers of the Rubber Growers' Association the reader is referred to R. G. A. Bulletins, February, 1924—August, 1925.

T. E. H. O'BRIEN,
Chemist.

RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
Neboda, October 15th, 1925.

A BROWN BAST CENSUS.

In 1923 a suggestion was made at a meeting of the Technical Committee of the Rubber Research Scheme that much valuable information about Brown Bast might be obtained by the study of the rate of increase of the disease over a known area.

A field of ten acres (1,000 trees) was selected for this purpose. It was believed that the disease was rather more prevalent in this particular plot than is usually the case in the Kalutara District.

Description of the Field.—The soil is of the usual rather washed out "cabooky" type common to the District, but rock is scarce and the field as a whole fairly level. It slopes gradually down at the north-west corner where there is some low-lying ground subject to flooding during the rains. Of the total number of trees 159 are affected by the flooding and about 50% of these are standing in soft wet ground. The effect of this water-logging of the soil is apparent on the trees. The bark, in some cases up to a height of eight feet is coloured a deep brown and the cork layer is thick and rough. In some of the extreme cases the trees are dying, all the bark having rotted away round the collar. Sphaerostilbe repens is probably present although search has not revealed any fructifications. Bark samples taken from some of the trees showed that the colour was widely distributed through the tissues. It was found, however, that the cortex internal to the cork cambium contained the normal quantity of starch, and latex was abundant.

The conditions under which the remaining trees are growing are uniform as far as can be judged.

Tapping.—The tapping system is one cut on half the circumference tapped on alternate days with an annual change of sides. Other systems have previously been employed as evidenced by the marks on the trees, but the above has now been practised for a number of years.

On many of the trees one finds triangular areas of bark which have not been tapped. Their presence is due to the change over from a V-cut to the present system.

Examination.—The following symptoms appearing together were taken as conclusive evidence of disease :—

Presence of the characteristic brown markings.

Absence of latex except from the innermost layers.

Sodden condition of the bark.

The continued welling up of beads of thickish or rapidly clotting latex from the cut some time after tapping is fairly conclusive evidence of the presence of Brown Bast in an early stage. No cases were found where the trees had gone dry from purely "physiological" reasons.

The first examination was carried out during September, 1923, the second October—November, 1924, and the third in October, 1925. The affected trees were put into three classes according to the stage of advancement of the disease—"badly diseased," "diseased" and "slight." It may be stated that only two trees were discovered which had developed nodules at all. The above classification is arbitrary and merely adopted for the purpose of studying the increase in severity of the cases. Certain other trees were put into a fourth class and remarked on as "doubtful," "impending." These were to be examined with special care during subsequent rounds.

In 1923, 135 trees were diseased. Certain of these were put into the "doubtful" class at the time of examination, but by the time of the second round they showed definite symptoms, and it is thought that this figure gives a correct estimate of the disease in 1923, a percentage of 13.5.

1924 showed an increase of 6.2%; this also including a number of doubtful cases verified in 1925.

1925 showed a further increase of 4.8%.

In 1923 special attention was paid to the side of the tree in tapping, except where there were special indications that the other side was affected. The same procedure was followed in 1924 except in the cases previously marked "doubtful." In 1925 both sides were examined and the figure given shows only new definite cases of disease.

A casual inspection of the field would not reveal the amount of disease actually present; many of the cuts are only affected over a few inches of their length, and unless this portion occurred at the top of the cut they would usually

pass unnoticed. This might be taken to indicate that a higher percentage than is usually imagined of the trees on any estate are diseased.

Treatment.—Early in 1924, the Superintendent carried out treatment by scraping and tarring of the badly affected trees. In all 88 trees were treated. Of these, 70 now show satisfactory renewal, but in the remaining 18 the treatment has been too drastic and the wounds formed will take some time to heal. In one case a wound 20″ by 10″ is beginning to callus over. It will readily be seen that this puts the tree out of action for a few years. I do not condemn the scraping method of treatment, but merely mention the wounding in these 18 cases to emphasise the fact that great care is necessary during the actual operation. In a number of the other cases treated, although the part actually scraped is now free from disease, and is renewing in a satisfactory manner, the outer limits of the spread of the disease have not been reached, and there is still Brown Bast round the edges of the treated part.

Other points noted.— It was noticed on this plot that the habit of the tappers when a cut went dry was to open a fresh cut higher up the tree. This practice is to be condemned. In all cases where this had been done the new cuts developed the disease in a short space of time. This is similar to the phenomenon mentioned by Kouchenius. He instances a case where the disease spread from the affected area on the cut to the wound formed by the breaking off of a branch much higher up the tree.

It was also noticed that the triangular pieces of bark, mentioned in the paragraph on tapping were in many cases affected with Brown Bast, while the rest of the tree was free. The fact that this had not spread rather supports the isolation method of treatment. The bark all round had been tapped away, and so the equivalent of an isolation channel formed. The 1925 examination showed that many of these "islands" now had latex in the inner layers, demonstrating that the new layers of tissue laid down by the cambium had not become affected by the disease.

Disease in the flooded area.—Of the total 159 trees subject to flooding 15 were diseased. This figure includes one or two "doubtful" cases and so can be taken as an absolute maximum. Thus the percentage of affected trees,

9.4%, is considerably less than that found over the plot as a whole. Were it not the case that it is impossible to tap these trees during certain months of the year, this might be taken as fairly conclusive evidence against the statement that excessive humidity is a predisposing factor.

Plan of the plot.—These examinations were carried out with the object of gathering information on the various theories on the cause of Brown Bast and not in support of any one in particular. In 1924, with the assistance of the Mycologist, a rough plan of the plot was made to see whether there was anything in the apparent grouping of the cases. The plotting in coloured pencil of the trees affected showed three fairly distinct groups but the scattered nature of the many other cases made the suggestion that these surrounded centres of infection untenable.

Number of cases where the disease has reached an advanced stage.—As mentioned above many of the cases are slight, and are not yet interfering to any extent with the yield. Most of the trees where the cut had gone dry and the diseased had spread to any extent were treated in 1924. There are 9 trees now classed as "badly diseased," and one of these is included in the 88 previously treated. This gives a total of 96 bad cases in the plot, a percentage of 9.6%. This is the number which would be obtained by a casual inspection or by anyone not trained to recognise the disease in early stages.

Thanks are due to the Superintendent of the estate for the help he gave in many ways, particularly with regard to the numbering of the trees.

R. A. Taylor,
Physiological Botanist.

Research Scheme Laboratories,
Culloden Estate,
Neboda, 20th October, 1925.

THE EFFECT OF MANURING ON THE FOLIAGE-COVER IN RUBBER.

The effect of manures of various kinds on the *yield* of rubber has often been the subject of experiment, but little attention has been paid to the results of such treatment on the other vital functions of the tree. This is perhaps due, in part, to the difficulty of obtaining an accurate measure of such results except in the cases of the effect on girth, cortex-thickness, and number of latex-vessel rows.

In 1922, the Superintendent of Gallawatte Estate, Kalutara, suggested the carrying-out of an experiment by the Rubber Research Scheme to test the effect of manuring on the incidence of abnormal leaf-fall. An experiment on these lines was devised, and the first tests on the plots were made this year, that is to say, after the third year's application of the manure. Incidentally, yields from the plots under the different treatments have been kept, but it has been decided to continue these records for another year before consideration of the results.

Description of the Experiment.—A plot was chosen on Gallawatte Estate containing some seventeen hundred trees planted in well-defined rows of about thirty trees each. The whole area includes a valley, so that the field slopes gently down from one end (plots 5A and 5B) to the other, while the individual blocks slope steeply up on each side of a central stream. The plots were numbered and arranged as follows:—

1B.	Control.
1A.	Manured, nitrate of soda. 5 cwts. per acre.
2B.	" " " " " " "
2A.	Control.
3B.	"
3A.	Manured, Nitrate of Soda. 5 cwts. per acre.
4B.	" " " " " " "
4A.	Control.
5B.	"
5A.	Manured, Nitrate of Soda. 5 cwts. per acre.

The manure was applied in two doses of 2½ cwt. per acre during March, 1923, March, 1924, and in February and March, 1925. The ground was "envelope forked" and the manure

thrown in the furrows. Previous to the experiment the area was last manured in 1920.

The only feasible method of determining the density of the overhead cover proved to be by obtaining a measure of the intensity of the light under the trees in the separate plots. The most satisfactory means for this purpose was an ordinary photographic exposure-meter of the actinometer type. With this instrument the time required for a piece of sensitive paper to darken to a standard tint is taken as an inverse measure of the intensity of the light. The tests were carried out with the assistance of the Chemist to the Research Scheme.

Three main sources of error had to be overcome :—

(1) The large variation in the intensity of the light at points only a few inches apart, owing to sunlight striking through between the leaves. The "mean illumination" is what is required to be found. This difficulty was met by walking steadily forward between the middle rows of the plots with the actinometer held in the extended hand, while the readings were made. In this way a fair average exposure to light and shade was obtained.

(2) Variations in the intensity of the incident light during the course of the whole series of tests. This was overcome by taking simultaneous readings in a manured plot and its adjacent control. Thus, although the light varied from time to time, the total intensities throughout the tests were the same for the manured plots and the controls.

(3) Personal error due to possible differences in judging the point at which the two tints matched. To meet this, after one set of simultaneous readings was finished positions were exchanged and a new set for the same plots taken.

About five readings were taken in each test and the average of these considered as the figure for that test. In the analysis of the figures which follows the averages so obtained have been tabulated for the control and the manured plots separately and the "probable error" of the mean of each set calculated. For a complete exposition of the "probable error" method of analysing results reference should be made to Bulletin No. 66 of the Department of Agriculture* or to

* Experimental Errors of Field Trials with Hevea. C. H. Gadd, Department of Agriculture Bull. 66.

any standard text book on genetics or biometrics. It is sufficient here to point out that the "probable error" of the mean of a set of results is a figure expressing the limits of a range within which it is an even chance that the true mean lies. It is calculated from the standard formula

$$\text{P. E.} = \pm 674 \sqrt{\frac{Sd^2}{n-1}} \times \frac{1}{\sqrt{n}}$$

where Sd^2 = the sum of the squares of all the "deviations" from the mean;

and n = the number of results, or the "frequency."

$n-1$ is used rather than n as divisor as it is applicable in all such cases where there is any doubt as to the "true value" of the errors or "deviations." Its use results in a somewhat larger value for the probable error, but this is to the good, as will be evident in the later discussion.

The actual actinometer readings were as follows:—

ACTINOMETER READINGS.

1B (Control)		1A (Manured)		2B (Manured)		2A (Control)		3B (Control)	
Set I	II	I	II	I	II	I	II	I	II
80	65	80	105	59	49	25	45	26	26
86	75	110	95	67	56	24	43	25	18
71	65	63	65	64	75	27	46	28	22
59	55	77	65	73	56	24	38	30	26
58	65	—	—	—	75	21	50	32	30
70.8	65.0	82.5	82.5	65.75	62.2	24.2	44.4	26.2	24.4

3A (Manured)		4B (Manured)		4A (Control)		5B (Control)		5A (Manured)	
I	II	I	II	I	II	I	II	I	II
45	40	28	52	55	16	25	40	47	55
40	52	38	37	30	17	30	35	47	55
40	40	28	45	33	20	27	37	55	—
51	52	31	53	38	12	27	35	—	—
47	—	39	55	—	17	35	—	—	—
—	—	—	—	—	15	—	—	—	—
44.6	46.0	32.8	48.4	39.0	16.2	28.8	36.75	49.6	55.0

These means may now be tabulated as follows:—

CONTROL PLOTS.

Average Readings.	Deviations from Mean. = d	d^2
70.8	33.2	1102.0
65.0	27.4	750.8
24.2	13.4	179.6
44.4	6.8	46.24
26.2	11.4	130.0
24.4	13.2	174.2
39.0	1.4	1.96
16.2	21.4	458.0
28.8	8.8	77.44
36.8	.8	.64
Mean = 37.6		$Sd^2 = 2920.88$

$$\text{P. E.} = \pm 674 \sqrt{\frac{2920.88}{9}} \times \frac{1}{\sqrt{10}}$$

$$= \pm \frac{.674\sqrt{324.5}}{\sqrt{10}}$$

$$= \pm 3.84$$

MANURED PLOTS.

Average Readings.	Deviations from Mean. = d	d^2
82.5	25.6	655.4
82.5	25.6	655.4
65.8	8.9	79.21
62.2	5.3	28.09
44.6	12.3	151.3
46.0	10.9	118.8
32.8	24.1	580.8
48.4	8.5	72.25
49.6	7.3	53.29
55.0	1.9	3.61
56.9		$Sd^2 = 2398.15$

$$\text{P. E.} = \pm 674 \sqrt{\frac{2398.2}{9}} \times \frac{1}{\sqrt{10}}$$

$$= \pm 3.48.$$

Now, considering the cover on the control plots to be the normal for unmanured rubber, we require to know how much more cover there is on the manured plots, and what degree of reliance can be placed on the result. As mentioned above, the actinometer readings may be taken as inversely proportional to the intensity of the light; that is, as directly proportional to the degree of shade.

To obtain the required figure we need to know the difference between these two means and the probable error of the difference, and then to calculate what percentage of the figures for the controls this represents and the probable error of this percentage.

The P. E. of a difference between two results having probable errors of E_1 and E_2 is

$$\pm\sqrt{E_1^2 + E_2^2}$$

In this case

$$\text{P. E. of difference} = \pm\sqrt{(3.48)^2 + (3.84)^2}$$
$$= \pm 5.17$$

That is, the difference between the two means is

$$19.3 \pm 5.17$$

The P. E. of a quotient is obtained by the same formula as for a difference so that the percentage of the controls represented by the difference

$$= \frac{19.3 \pm 5.17}{37.6 \pm 3.84} \times 100$$
$$= 51.3 \pm \sqrt{(5.17)^2 + (3.84)^2}$$
$$= 51.3 \pm 6.4\%$$

That is to say there is 51.3 ± 6.4% more cover on the manured plots than on the controls. Now this probable error gives, as stated above, only an even chance that the true mean lies between the limits so defined; that is it is even chances that the true mean lies between 44.9 and 57.7. To increase these chances to practical certainty it is sufficient to multiply the probable error by 3 (giving chances of 95 in 100). Thus it is almost certain that the true mean lies between 31.1 and 70.5%. We can therefore be sure that there is *at least* 30% more overhead cover on the manured plots than on the controls, while it is highly probable that it is nearer 50%.

It will be seen from this that it cannot necessarily be concluded that this difference is due to a greater *loss* of leaf by the control plots; it may, in part, be due to an originally greater amount of leaf on the manured plots before the onset of abnormal leaf-fall.

All that can be concluded is that, whatever the cause, there is at least 30% more foliage on the plots treated with nitrate of soda than on the untreated plots.

During next year the tests will be repeated both before and after the yearly attack of Phytophthora leaf-fall, so that it may be determined whether the application of nitrate of soda brings about the observed difference by actually increasing the amount of foliage on the trees or by increasing the resistance of the leaves to Phythophthora attack, or whether both factors are operative.

R. H. Stoughton-Harris,
Mycologist.

Research Scheme Laboratories,
Culloden Estate,
Neboda, October 17th, 1925.

PLASTICITY OF RAW RUBBER.

The raw rubber of commerce, except in the case of blanket crepe used for soles, is not in a suitable condition for direct use by the manufacturer, but has generally to be kneaded or masticated on a pair of rolls until it is soft, sticky and dough-like. Even the rubber used for making solution has to be masticated for some time before treatment with solvent. In the case of the majority of articles the physical properties of the raw material require modification by the addition of other substances as well as by vulcanisation, and the rubber has to be kneaded or masticated in the factory before the various compounding ingredients can be worked in. This kneading operation also serves to render the rubber mixing sufficiently plastic to assume under pressure the shape of the article into which it is being manufactured.

Frequent variations occur in the plasticity of mixings in daily use, and the shaping machines have to be re-adjusted from time to time to suit the altered conditions which is a serious hindrance to economical working. Moreover it not infrequently occurs that the customary mastication fails to produce a mixing sufficiently plastic to be brought to the required shape by any adjustment of working conditions and much time is wasted in re-kneading the mixing or in preparing fresh material.

For instance, in the manufacture of solid tyring, rubber hose, tubing, tyre treads, cabling, etc., the mixing is forced through a shaped orifice in order that the form desired may be obtained. If the mixing is not sufficiently plastic it emerges with a rough surface and jagged edges, with the result that the kneading and the extruding has to be repeated.

Moreover it is sometimes found impossible to extrude the mixing satisfactorily even after further kneading, causing still more delay and dislocation while another batch of mixed rubber is prepared.

Similarly other important processes which are employed to give the rubber mixing the desired shape, such as calendering and frictioning, cannot be successfully performed unless the mixing is first rendered sufficiently plastic.

Although there are a number of uncontrolled factors in the manufacturing operations, which may be partly responsible for batches of mixed rubber failing to extrude, calender or friction properly, manufacturers are of opinion that variation in the plasticity of raw rubber is the principal cause.

Special attention has therefore been devoted at the Imperial Institute for some time to methods of measuring the plasticity of rubber, and a system of testing is being developed which it is expected will give information of practical value.

A large number of preliminary tests have already been carried out, but until a definite scheme of testing has been finally approved and is in operation it is not considered desirable to publish details of the results. It is thought however that the following information as to the main conclusions arrived at in a set of experiments conducted on a fairly extensive scale may be of interest at the present stage.

These experiments were carried out on a series of 48 unsmoked sheets and crepes which had been prepared on four estates in different parts of Ceylon for comparative examination. All the samples from each estate were prepared from the same bulked latex, some of them being dried in air in the usual way, and the others kept wet for a considerable period. It was found that in the case of each estate the crepes were more plastic than the unsmoked sheets, and that keeping the rubber wet for a considerable period and then washing at the Imperial Institute did not alter the plasticity of the rubber. Both the crepes and the unsmoked sheets from one of the estates were more plastic than the corresponding forms of rubber from the other three estates.

Investigations are now in progress with a view to (1) improving the methods of testing, (2) determining the extent of variability in the plasticity of Ceylon estate grades and its relationship to time of vulcanisation, (3) determining the cause of any variability that may be found.

IMPERIAL INSTITUTE,
LONDON S.W. 7.
September, 1925.

REPORTS RECEIVED.

(a) Report on "Plasticity of Rubber" (included in present Circular).

(b) Second Interim Report on "The Effect of Different Conditions of Smoking." (To be incorporated in a Bulletin on the "Smoking of Rubber" to be issued when the investigations are completed.)

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